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ABSTRACT

This issue paper discusses principles of good management of construction and some options Georgia may use in the future to manage school construction and control costs. The paper begins by providing some background on common forms of construction management and delivery. Then the paper discusses principles of good contracts. The background section concludes with some information on factors that influence the cost of construction once the design is complete and background on construction materials. The next section of the paper, "Current Conditions," looks at what school systems and the state are doing related to construction. The third section of the paper highlights specific findings about the construction process and the current state activities related to school construction. In the final section of the paper, various alternatives are presented related to construction materials and techniques, costs of construction, construction management and delivery, and contractual issues that could improve school construction in the state of Georgia. (EV)

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Construction of Educational Facilities

Governor's Education Reform Study Commission

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Executive Summary

The State of Georgia, through the Georgia Department of Education Capital Outlay funds[1], contributes funds to construct an average of nearly 40 new schools per year.[2] Theses projects receive a maximum state contribution per project if the school meets the required DOE requirements. The decision to construct a new school is a local decision based on the school system's five-year facilities plan. Each school system is responsible for preparing a five-year facilities plan that helps the school system plan for its future facilities needs. When a local school system decides to build a new school, it is also responsible for the management of the design and construction process.

This issue paper first examines four common construction delivery and management methods. These methods are: Design/Bid/Build-General Contractor, Construction Management at Risk, Design/Build and Construction Management – Agency. Of these delivery methods, the state uses all but Design/Build for school construction. No conclusive data is available on which method is best for school construction.

Traditionally, construction oversight has been the responsibility of the design professionals (a.k.a. architect). Today, most design professionals are backing away from an intensive role in construction oversight. Owners desiring more intensive construction oversight are required to purchase additional project administration services from the architect or others at an additional fee. Some school systems fulfill this need by hiring additional staff to provide some construction/program management services. Other school systems contract with a construction management firm or the original design firm. To ensure that the owners are getting their monies worth and the construction is in accordance with the plans and specifications will require more intensive construction presence and inspections.

The second topic covered in the paper is construction contracts. Contracts are the mechanism that communicates the work to be done and what is required of each party. In construction all parties, owners, architects, engineers, and contractors all have their own legal counsel and all require specific contractual requirements. The construction contracts from the design professional and the construction professional are separate contracts and each approaches the project from a different perspective. In Georgia, most local school systems currently use the American Institute of Architects (AIA) standard contracts and modify them to fit their conditions, for both their design professional and their construction professional. Some of the larger school systems have had their own legal counsel develop specific construction contract documents for the system's use. The state does not have any data to evaluate which contracts work best.

The state does not require or keep a file of all construction contracts for school construction. Only the contracts for projects using capital outlay funds are kept on file. No standard state construction contracts are used.

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[1] The state does not maintain information on the total number of schools built per year. Only facilities built using Capital Outlay Funds are tracked.

[2] Georgia Department of Education Facility Services Section.

Good management of construction controls costs. Though most of the costs of construction are decided in the design phase, there are factors that can affect the cost of the project once the dirt is moved. Many factors can influence the cost of construction after the dirt has been moved. The most common factors are errors and omissions, change orders from the owner, construction delays and manufacture delays.

The cost of constructing schools in Georgia is lower than most other states in the nation. The reported cost of school construction nationally is $127 per square foot. The average cost per square foot in Georgia for schools under construction in 1999 and using state Capital Outlay funds was $75.63/sq.ft (this cost includes site costs). The range of costs per square foot varies from $55.70 to $99.33 per square foot. The type of facility or the wealth of the community and the cost per square foot do not appear to be correlated.

Reliable data on the costs of all new school construction for the whole state is not available. Some data is collected on schools constructed with state capital outlay funds. No data regarding change orders, evaluations of projects and contractor performance are collected by a centralized information system.

The fourth topic discussed in this paper is the selection and use of materials. Today, the types of materials used in school construction are fairly uniform around the nation due to building and life-safety codes, time tested durability and low maintenance cost. Most schools today are built with a concrete foundation with concrete masonry units (CMU) foundation walls or concrete slab. Some states, as part of their design standards, have an approved list of materials that are proven and appropriate for school construction. To allow maximum local input, Georgia does not have state guidelines regarding the choice of materials. Because of limited funds for school construction, in many case the architect selects materials that are both durable and have a low initial cost. Local school systems depend on their in-house staff or design profession to select materials.

In Georgia, school construction has long been a local activity, with minimal input from the state. However, the state is responsible for a certain percentage of funding for new school construction so the state does have a vested interest. For each of the alternatives listed, various levels of state input exist. Future state policy and procedure will be determined by when and how state leadership decides to guide school construction decisions. The alternatives to improving the way the state manages construction are grouped into four main themes. The state could:

1. Compile data to understand the current practices.
2. Document best practices.
3. Provide technical and expert assistance and guidelines.
4. Require specific actions related to management of construction.

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I. INTRODUCTION

The State of Georgia, through the Georgia Department of Education Capital Outlay funds[3], contributes funds to construct an average of nearly 40 new schools per year.[4] Theses projects receive a maximum state contribution per project if the school meets the required DOE requirements. The decision to construct a new school is a local decision based on the school system's five-year facilities plan. Each school system is responsible for preparing a five-year facilities plan that helps the school system plan for its future facilities needs. When a local school system decides to build a new school, it is also responsible for the management of the design and construction process.

A successful construction project is measured in several ways. First is if the project is completed on time and within budget. Other criteria include the number and magnitude of change orders – the origin and rational, non-repetitive mistakes, safety, performance of subcontractors, quality, and partnering relationships.

"Good [management of] construction does not happen by accident. It is systematic, relentless and deliberate. It results in projects being completed at a lower cost, within budget, on time, and at a reasonable standard of quality. These methods are time-tested and have proven to work."[5] Rigorous planning and quality designs, quality construction oversight, and thorough contracts are key components to a successful construction project. Other factors that contribute to successful construction of a school include:[6]

- ∑ Adequate lead time
- ∑ Complete scope definition and program prior to design
- ∑ Adequate fees for design and construction support
- ∑ Thorough and enforceable contract documents
- ∑ Careful selection of design and construction practitioners
- ∑ Effective pre-qualification of key contractors and subcontractors
- ∑ Use of partnering
- ∑ Effective and prompt payment process
- ∑ Careful monitoring of schedule and costs
- ∑ Minimal changes once the work is in progress
- ∑ Broadly shared responsibility for safety
- ∑ Efficient close-out procedure
- ∑ Clear demarcation between construction and maintenance
- ∑ Thorough documentation
- ∑ Timely follow-up

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[3] The state does not maintain information on the total number of schools built per year. Only facilities built using Capital Outlay Funds are tracked.
[4] Georgia Department of Education Facility Services Section.
[5] Steele, Jim. "A Report to the Governor's Education Reform Study Commission," July 20, 2000.
[6] "Avoiding Pitfalls in School Construction," Georgia Department of Education Facility Services Section Conference, February 24, 1998.

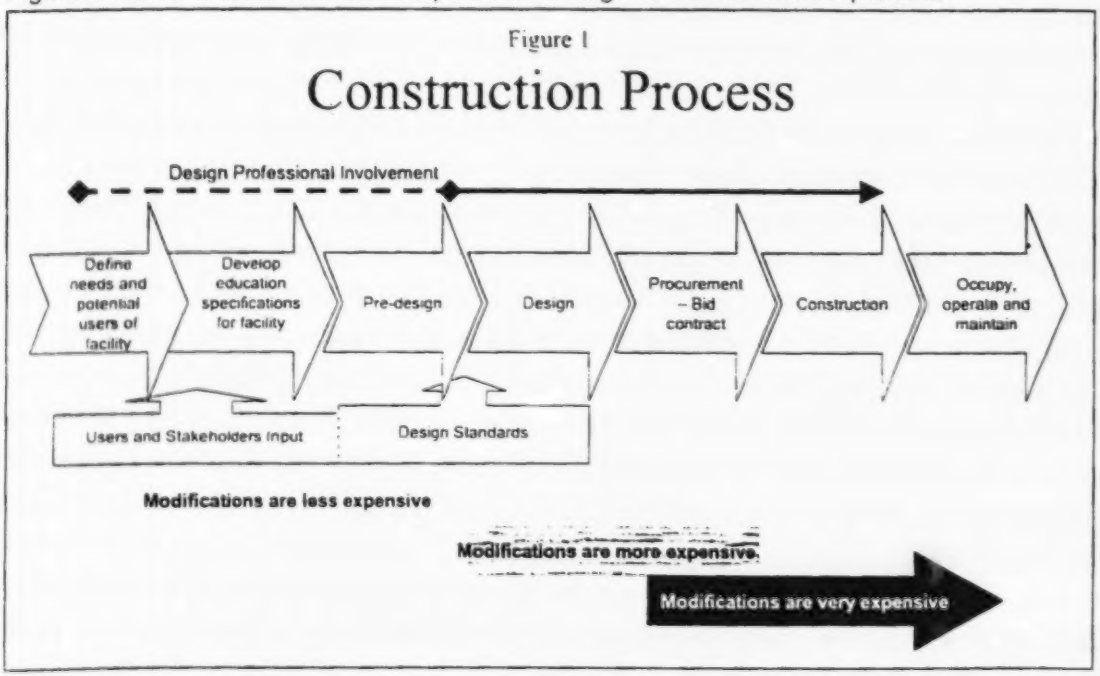
This issue paper will discuss principles of good management of construction and some options the state may use in the future to manage construction and control costs. This paper begins first by providing some background on common forms of construction management and delivery. Then the paper discusses principles of good contracts. The background section concludes with some information on factors that influence the cost of construction once the design is complete and background on construction materials. The next section of the paper, Current Conditions, looks at what school systems and the state are doing related to construction. The third section of the paper highlights specific findings about the construction process and the current state activities related to school construction. In the final section of the paper, various alternatives are presented related to construction materials and techniques, costs of construction, construction management and delivery, and contractual issues that could improve school construction in the State of Georgia.

II. BACKGROUND

The Construction Process

Figure 1 below shows the main steps of the design and construction process.

Figure 1



The design phase is the most important phase in any construction project as it determines the scope and eventual cost of a new facility. Based on best practices, during this phase stakeholders, including faculty, staff, administration, students, parents, community leaders, and design and construction experts, provide input on the design and plans. During this phase priorities can be easily modified to meet both the needs of the local system and community. Factors such as materials, equipment, short-term and

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long-term needs, use, and cost should be weighted and trade-offs analyzed. Once the design is complete, the time for debate is past because additional changes become increasingly more expensive.

Having a detailed and coordinated set of plans in place before the dirt is moved mitigates cost overruns because the number of costly change orders and miscommunications is significantly reduced. As the construction of the facility progresses, the ability to modify the design, components and interior fixtures is increasingly limited. Rigorous planning and design increase the probability of lower construction costs due to fewer changes. Using a traditional design/bid/build method, the next step in the process, once the final design and construction documents are completed, is for the project to be bid on by contractors. Based on predetermined selection criteria the bidders are evaluated and a contractor is awarded the project. Coordination between the owner (school system), architect, contractor and any other construction or program management firms continues until the building is complete and all the systems in the facility have been checked and are working properly (known as building commissioning).

This paper discusses four broad categories related to the construction of schools. These categories are management of construction and construction delivery methods, second contracts, third, costs of construction and fourth, construction materials.

A. Management of Construction and Construction Delivery Methods

Traditionally, construction oversight has been the responsibility of the design professionals (a.k.a. architect). Today, most design professionals are backing away from an intensive role in construction oversight. They are redefining and limiting their role to general observations, reviews, and familiarity with construction process and quality. Owners desiring more intensive construction oversight are required to purchase separate project administration services from the architect or others at an additional fee. Some school systems fulfill this need by hiring additional staff to provide some construction/program management services. Other school systems contract with a construction management firm or the original design firm.

When selecting a contractor, pre-qualifying the potential is a common best practice. For example, in the Gwinnett school system, potential contractors must pre-qualify. To pre-qualify, contractors must attend the pre-bid conference and have documented acceptable performance on similar projects.

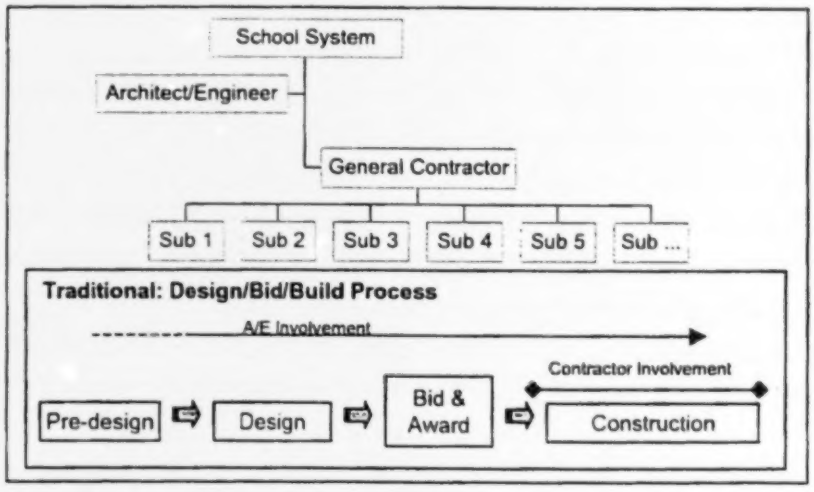
Whether done in-house or outsourced, some form of independent construction oversight is needed at the jobsite. The construction process is a daily flow of material and labor. As a normal practice, material is set in place and is soon covered over with the finish skin or concealed. If the design professional or inspector is not present to inspect or review in an allotted time as specified in the contract, mistakes and errors could go undetected, causing costly repairs, rework, or future maintenance problems. Without these inspections there is no assurance that work complies with the contract documents. Independent construction oversight also aids in budget and schedule

control, coordination of subcontractors, and design of operations. This oversight can also add value in procurement.

Often times a program manager will perform audits on the process and cost during the duration of the construction process. This helps the owner know and control the actual cost of the project.

Four construction delivery methods are most common in the public sector, but no single approach is best in all cases. These four methods have variations depending on the type of construction oversight being used. "Each option places the major participants in different roles and assigns different responsibilities. Each allocates risk – and reward – in different ways. Depending on the situation and the owner's needs, each is more or less appropriate . . .. Each delivery option presents different opportunities and makes different demands [on the owner, architect, and constructor]".[7]

1. Design-Bid-Build- General Contractor



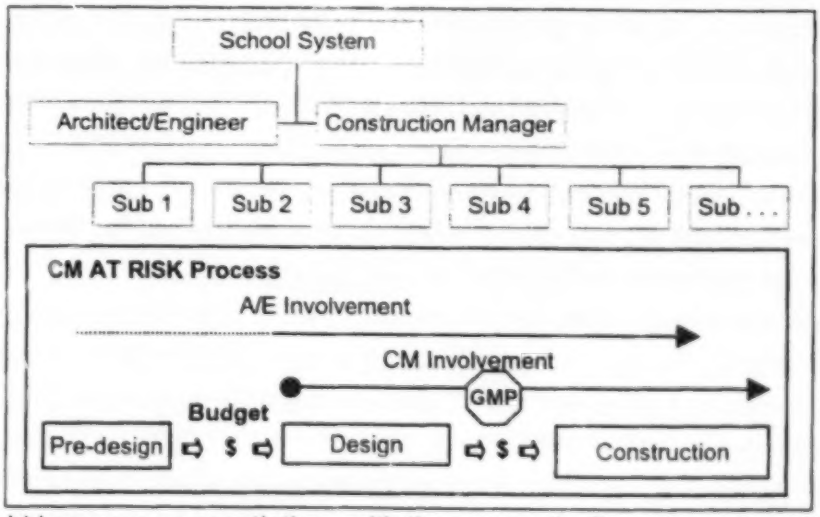
The design/bid/build model of construction is the most common method used for government projects. First the owner hires an architect to design the project and develop the construction documents. The owner, often with the assistance of the architect, then selects a qualified contractor to construct the project based on competitive bids.

[7] Haviland, David, ed. The Architect's Handbook of Professional Practice: Delivery Options. American Institute of Architects Press, 1994.

The advantages and disadvantages of design/bid/build include:

Advantages	Disadvantages
∑ Familiar – easy to understand ∑ Proven track record ∑ Complete documents prior to bidding ∑ Lowest price through competitive bidding ∑ Maximum architect involvement ∑ Single source of responsibility during construction ∑ Long period of time for input and design changes	∑ Cost unknown during design ∑ Potential adversarial roles between players ∑ No contractor input during design phase ∑ May lead to change orders

2. Construction Management at Risk



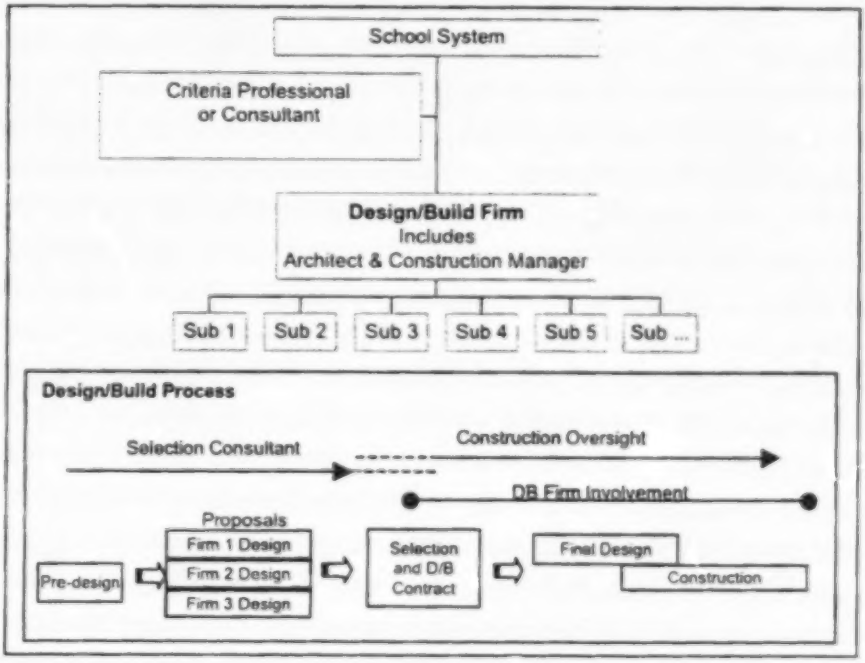
The construction management at risk (CM at Risk) process makes the construction manager a member of a collaborative project team. The construction management firm (CM) is selected based on pre-determined criteria and hired after a competitive bid process or negotiations with the owner. (In Georgia a competitive bid is required.) The CM then works with the school system and the architect to develop a project and budget. The CM firm develops the project with the architect during the design phase and as the project nears final design, they propose a guaranteed maximum price (GMP). Then, depending on the terms of the contract, the CM firm bids out the subcontracted jobs.

CM at Risk is not only a delivery method for construction, but also a method of construction oversight. Depending on the contract, the CM at Risk may be either the program manager and/or contractor and holds the contracts and hires the sub contractors. If open competition is an issue, the CM at Risk publicly bids out the trade contracts for the various components of the project the same way that the general contractor would be selected for a design/bid/build.

The advantages and disadvantages of construction management at risk include:

Advantages	Disadvantages
∑ Early cost commitment – GMP ∑ Contractor input during design phase ∑ CM administers construction ∑ Single source of accountability for construction (CM)	∑ Added cost for CM fees ∑ Requires more work upfront in selection and decision making

3. Design/Build



The design/build method of construction collapses the time frame of activities of the design phase and construction start-up. Consortiums or firms compete for a design/build project by submitting conceptual designs and bid prices. The entity with the best combination of qualifications, design, and price is awarded the project. The design/builder is then responsible for designing, constructing, and equipping the new facility. To conserve time, the site improvements usually begin before the final design for the project is complete. Changes to the project can be made during the construction phase, but only up to a critical point.

The advantages and disadvantages of the design/build with competitive bid include:

Advantages	Disadvantages
∑ Single source of responsibility and accountability ∑ Eliminates claims of omissions and errors ∑ Increased opportunity to realize synergies	∑ Selection process requires more staff to administer the design competition ∑ Owner loses the ability to easily influence and control the design – modifications are implemented by change orders ∑ Not conducive to design changes ∑ Owner loses independent opinion of design professional

4. Construction Management - Agency

Construction Management by Agency (CM-Agency) is where the school system hires a construction management firm on a professional services contract to represent and assist the school system through the whole construction process. This option is less of a delivery method, and more management of construction. With this option, the owner still holds the contracts and takes the risk. The CM-Agency receives a negotiated flat fee for managing the project for the school system. The CM-Agency is independent from the designer and general contractor and helps the owner select the designer and the general contractor. This type of oversight can be used to manage a variety of construction delivery methods, but it is most commonly used with the design/bid/build method. Defined broadly, CM-Agency is similar to program management in function and purpose. The difference between CM-Agency and program management is usually where the expertise of the firm is placed. CM firms are customarily staffed with more construction managers, while program management firms often provide broader design, engineering, and construction support.

The advantages and disadvantages of the CM-Agency include:

Advantages	Disadvantages
∑ Added management expertise during project duration only ∑ Contractor input during design phase ∑ CM Agency assist owner in the administration of construction contractor ∑ Third party budget and schedule control and coordination	∑ Owner is at risk ∑ Owner hold multiple contracts with trade contractors – potentially adversarial ∑ Overlapping authority ∑ Lack of single source of accountability ∑ CM Contract negotiated – not bid

These different methods are each different in how they help the owner manage the construction process. No reliable comparison data is available on cost savings or time to completion that is solely or directly related to delivery method, given all other aspects of the project being equal. Usually the school system decides over time, on a case-by-case basis, what method works best based on the system's in-house skills and the nature of the project.

B. Contractual Issues

For the first half of the century the public construction process was relatively simple. Local public bodies, contractors, and architects worked together in relative harmony, each practicing their profession and always safeguarding their reputation in the community. A good set of plans and specifications together with the personal attention from each construction professional meant that the project was built on time and within budget. Today we live in a different environment:

- ∑ Owners, architects, engineers, and contractors all have their own legal counsel.
- ∑ All require specific contractual requirements.
- ∑ The contracts with the design professional and the construction professional are separate contracts and each approaches the project from a different perspective.
- ∑ Different industries or individuals often write the design and construction contracts.

Good contracts can help assure good communication and timely dispute resolution. The more the owner can communicate the expectations they have for the project up front in the contracts the more accurate the cost will be. Design or construction contracts, broadly speaking are nothing more than written agreements between parties. These two contracts establish the eternal triangle of construction of Owner – Contractor – Design Professional. The contract also is an agreement and description of the roles, rights and obligations of the owner, architect, and contractor on how they will each be held accountable for the execution of the project. These same contract documents between the parties may also constitute the battleground on which most future disputes will be fought. With this in mind it behooves the owner to give careful attention in the development of these contract documents.

The contract should address alternatives for dispute resolution, including litigation, arbitration, negotiation, and mediation. Alternatives to litigation can often save money in resolving disputes. This is why there is a trend today toward specifying arbitration or mediation *in the contract* as the required method for dispute resolution, before any problems even arise.

Construction contracts should contain certain clauses, including:

- ∑ Definitions
- ∑ Owner requirements
- ∑ What is needed to complete the project in the time allotted

- ∑ What is required and expected of each party (roles and duties of each player)
- ∑ Specifications of the work to be done
- ∑ Definition of prompt payment
- ∑ Clauses that cover dispute resolution, change orders, and claims. The contract should explain the process to resolve problems without adversely affecting the cost or time.

The owner needs to be educated on not only construction issues and topics, but also contractual issues. If construction is not a core competency of the owner or the owner's, the school system should consider hiring this expertise from a consultant, contract manager, program manager or construction attorney. Assistance in the development and review of contracts is always sound practice.

C. Construction Costs

The American School and University does an annual survey by region of school construction costs. The May 2000 issue shows the breakdown of construction costs as follows:

Average Percent of Construction Budget for K-12 Schools[8]	
Construction	81.20%
Furnishings and Equipment	5.60%
Fees (A/E)	5.90%
Site Purchase	2.70%
Site Development	4.60%

This data is based on averages of reported costs. The range of costs will vary greatly on a case-by-case basis depending on the site, materials, and design.

Although the majority of funds are expended on construction, most of the cost is determined in the design phase before construction begins. However even with a good design there are factors that can also add or avoid extra costs during the construction stages (after the bid is awarded). The following describes some of these factors.

Change Orders

- ∑ Owner directed changes – These are changes the owner requests after the plans are finalized and agreed on. An owner-directed change order might include the location of a door or additional classrooms for example.

- ∑ Errors and omissions – These change orders arise out of a flaw in design and mistakes in plans or specifications. The contractors should be responsible for notifying the owner of these types of problems and the need for a change order.

- ∑ Differing Conditions - Other changes could arise from unforeseen site conditions.

[8] Agron, Joe. "Through The Roof," American School and University, May 2000, p.46.

The additional expense of change orders is a common benchmark for quality design and construction management. For example, the Gwinnett school system has a change order rate of less than half of one percent (< .5%)[9]. United Parcel Service (UPS) has a practice to keep the change orders on their projects under the industry benchmark of two percent.[10]

Contract Issues

- Litigation - Disputes that the contractual clauses do not address that cannot be resolved, often go to litigation and court. This is a very expensive and time-consuming process.

Construction Delays (time table)

- Delays in the construction timetable can be expensive. On the contractor side – if supplies and equipment are not delivered on time, the project may have to wait. On the owner side – delays due to changes in design or ordering of furniture, fixtures, and equipment (FF&E) could delay the completion of the project.

- Liquidated damages paid by the contractor are typically used to offset the owner's costs of delayed completion such as rental of temporary space.

Learning curve costing (same contractor)

- When negotiating price with contractors and subcontractors, learning curve costing could trim the bids slightly. For example, a contractor that has installed the same system several times can do it quicker because they know the procedure.

Partnering and progress meeting – communication

- Cooperative meetings with all parties involved in the construction of the facility throughout the construction process help to resolve concerns, plan for or avoid possible delays, and minimize change orders.

Field specialist

- If possible, having a construction specialist in the field to represent the owner and provide timely problem solving keeps the project flowing and on time.

Competition among bidders and suppliers

- An open bid system helps ensure that the school system will get the acceptable best quality product at the lowest competitive cost.

Use of common building materials and methods

- These are well understood, pose no learning curve requirements, reduce rework, and are easy and convenient to procure.

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[9] Steele, Jim. "School Construction: A Report to the Governor's Education Reform Study Commission," July 20, 2000.

[10] Wright, Albert L., UPS Vice President for Plant Engineering, Interview, September 20, 2000.

- ∑ Some newer materials are available that save time and money due to ease of installation or reduced skill requirements - these are discussed in later sections.

- ∑ Shortages in materials, labor, and equipment can significantly affect the cost and availability of these resources.

Unanticipated or extreme conditions

- ∑ Weather and acts of God
- ∑ Terrain

Environmental conditions

- ∑ Presence of items of archaeological, cultural, or biological significance on site such as endangered species.

- ∑ Environmental contamination that requires mitigation or remediation.

Use of New Materials

The choice of materials and construction techniques used in today's school construction has been a result of several factors.

- ∑ First, policies, rules, or standards. For example, Georgia's Department of Education requires the use of non-combustible construction for all new schools and additions. In some states, the State Department of Education pre-qualifies certain materials for construction. If a school system wants to use materials that are not pre-qualified, they must get approval. If the materials cost more than the standard material, the school system bears the additional cost.
- ∑ Second, financial constraints and resources of the local school system.
- ∑ Third, competitive market pressures on the design professionals to maintain the owner's construction budget. Design professionals must choose lower initial cost material and systems to maintain the owner's budget.
- ∑ Fourth, local climate and environmental constraints. The local systems are familiar as to which products and building systems perform best in their local school environment based on past performance.

In Georgia the present choice of materials and construction techniques in school construction has evolved over the past 50 years. The typical 1940-1950 school building in Georgia was a wood frame, brick veneer, and shingled structure. In 1958 the requirement for non-combustible materials was instituted by the Department of Education. The wood-framed school designs were slowly replaced with steel-framed buildings with concrete floor slabs and walls of structural clay tile units or concrete masonry units (CMU). Non-combustible construction became the norm for new schools. This type of construction (with the exception of the structural tile units) continues today.

Today, the types of materials used in school construction are fairly uniform around the nation due to federal requirements, building and life-safety codes, and time tested

durability and low maintenance cost. From time to time there are new products that come to the forefront in the construction industry. The designers and construction professionals along with the market quickly evaluate the merits and worth of these new products. Products that fulfill their claims of cheaper and faster will get industry recognition and go on to fill their niche in the market.

A relatively new material called Aerated Concrete Block or "autoclaved cellular concrete" is new on the market and being marketed as an alternative for wall construction. This product has been in Europe for years but has just recently been manufactured in the U.S. This product has not caught on in school construction because the exterior facing is soft and can be easily damaged. However, it has a good insulation value (R-factor), is fire resistant, lighter, and easy to cut. As with all new materials, time, experience, and maintenance costs will tell if it will become a common construction material.

During the design phase, owners and designer must stay alert to the feasibility and availability of new products. Materials must be appropriate for the design, environment, and provide the best quality for the price and life cycle cost. There always exist a danger for the owner and design professional in utilizing new products. Case in point, the introduction of Polyvinyl Chloride (PVC) roofing membranes that were very popular in the mid 1970's. PVC roofing had been around in the northern states and Europe for 10 to 15 years or more prior to their introduction in the south. They were proclaimed as less costly and simple to install and less supervision was needed when installing the roof membrane. In fact they were less expensive and simple to install, but not many people foresaw the long term implications seven to eight years in the future for facilities in the South. The problem was that these roof membranes would lose their plasticity and fail. This failure was due to the increased intensity of ultra-violet radiation in the South. This solar effect caused the premature degradation of the plasticizer in the membrane resulting in shrinkage and eventually the chattering of the membrane resulting in a total roof failure. These failures came with little or no warning. Cases like this one have contributed to an overall doctrine of conservativeness with respect to choice of building materials and systems.

III. CURRENT CONDITIONS

A. Management of Construction and Delivery Methods

To fill the need for project oversight the larger school systems are currently hiring their own construction professionals to monitor the construction process. Some systems are placing additional individuals on staff for this function. Other systems are privatizing this function out to a program manager or resident engineer. The smaller systems may rely on their design professionals for this service.

Some state agencies like the Georgia State Finance and Investment Commission (GSFIC) are placing a resident engineer at the job site to act as the owner's on-site eyes and ears. While having no authority to interpret the contract drawings or to make judgments on suspected flawed constructed items, the resident engineer is present to

catalog, bring to the contractor's attention and record daily events and progress. This experienced individual provides an extra set of eyes on-site and can notify the design professional of suspected problems or deficiencies in the construction. The smaller systems with limited budgets must rely on the design professionals for this discipline.

Three of the four construction delivery systems discussed are currently used in the state for the construction of schools. However, those systems that elect to use the CM-Agency or CM at Risk method must follow additional DOE specific requirements if they are using state capital outlay funds. Other methods of construction delivery and oversight sanctioned by law are permitted. DOE only asks that it be allowed to monitor the plans and process.

B. Contracts

Most local school systems currently use the American Institute of Architects (AIA) standard contracts and modify them to fit their conditions for both their design professional and their construction professional. These documents:

- ∑ Are generic in nature.
- ∑ Contain only general definitions of roles and responsibilities of the owner, design ,and construction professional.
- ∑ Are sometimes modified to meet specific requirements of the project.

Generally small school systems use the unaltered generic AIA contracts. A few local school systems are currently employing their own legal counsel specializing in construction law to customize the AIA contracts for their use. These modified AIA contracts help the school system further identify the specific roles and responsibilities of all parties for the project. The contract also further identifies the expected performance standards of the design and construction professionals in these separate contracts. Some of the larger school systems have had their own legal counsel develop specific construction contract documents for the system's use. The state does not have any data to evaluate which contracts work best.

The state does not require or keep a file of all construction contracts for school construction. Only the contracts for projects using state capital outlay funds are kept on file. Contracts are developed by each school system by project. Changes in the law, policy or even preferences of the construction industry, design professional, or school board member could drive a modification to the contract. Best practices suggest that contracts should be modified based on lessons learned from previous construction projects. Learning from experience is less likely for a school system that does not construct a new school regularly. Contracts should be continuously refined so problems encountered in the past are not repeated.

C. Cost of Construction

Reliable data on the costs of all new school construction for the whole state is not available. Currently the state keeps data on projects receiving state capital outlay funds and receives an accounting of the total project cost of construction. However, this data is not easily accessible or detailed. No central information system exists that tracks and collects data on all school construction statewide. Without accurate management level data, the state does not know what it is getting for its investment and neither does the taxpayer. Taxpayers look to the state to be a reliable resource of information.

Additionally, due to limited state staffing, regular audits of the construction process for quality and cost are not part of the state program. Unless done at the local level, no follow-up audit is performed to evaluate the performance of the contractors or the plans,. The state has long had a locally based and monitored school construction policy.

According to a recent survey, the southeast region of the United States has one of the lowest square footage unit costs in the nation, as documented in the May 2000 issue of "American School & University ".[11] The national average cost per square foot for school construction is $127.10/sq. ft. The southeast region, region 4 (AL, FL, GA, KY, MS, NC, SC, TN) had an average cost of construction of $100.33/sq.ft. The cost of construction in this report attempts to capture just the cost of bricks and mortar (construction). The sample data may vary because the school systems surveyed self-report the data and some costs like site development may be included by some school systems and not by others.

If the same costs are taken into account, Georgia Department of Education data for 1999 for Capital Outlay projects indicates that Georgia has one of the lowest average construction costs for schools in the nation at $75.63/sq.ft (this cost includes site costs). The range of costs per square foot varies greatly going from $55.70 to $99.33 per square foot. The type of facility or the wealth of the community and the cost per square foot does not appear to be correlated.

D. Construction Materials

Today most school construction materials and construction techniques are similar in Georgia and other states. Most schools today are built with a concrete foundation with concrete masonry units (CMU) foundation walls or concrete slab. Normally the building super structure is steel members, stick framed, or pre-engineered frame with roof purlins. The interior walls are traditionally CMU masonry and floors are carpeted or have vinyl composition tile (VCT) flooring. The roof system is typically a standing seam metal roof or a membrane system. The ceilings are usually lay-in acoustical ceiling tracks and panels.

Some states have detailed design standards. Included in those design standards is a list of materials the state has pre-qualified for use in school construction. In Georgia,

[11] Agron, John, "Through the Roof", American School and University, March 2000, p. 31-54.

with limited funds available for school construction, the architect has to choose materials that are both durable and have a low initial cost. Experience indicates that CMU walls and VCT flooring meet these criteria. Not all material selections are as straightforward as CMU or VCT flooring. Sometimes materials with a lower initial cost are selected without considering the life-cycle cost, replacement cost, and/or maintenance cost.

IV. FINDINGS

A. Management of Construction and Delivery Methods

- ∑ There are no current minimum requirements for on-site construction oversight by design professionals.
- ∑ To ensure that the owners are getting their money's worth and the construction is in accordance with the plans and specifications will require more intensive construction presence and inspections.
- ∑ The current codes provide only for on-site inspections by the local building official for code compliance.
- ∑ Some local inspection departments are requiring the design professional to certify that their designs comply with and/or were constructed in accordance with the current codes.
- ∑ The local school systems seeking more intense level of oversight must insert additional contract language for locally funded projects to have an A/E certify that the facility was constructed according to the plan and contract. Full certification by the architect and engineers that the building was constructed in accordance with plans and specifications will add additional time and money.
- ∑ The state only allows three forms of construction management for projects using state capital outlay funds. Other methods are approved on a case-by-case pilot project basis.

B. Contractual Issues

- ∑ Most school systems use either the AIA contracts verbatim or modify them slightly.
- ∑ The state requires an addendum on all architect contracts to require the architect to meet the local system budget and other requirements.
- ∑ No standard state construction contracts are used.

C. Cost of Construction

- ∑ Many factors can influence the cost of construction after the dirt has been moved. The most common factors are errors and omissions, change orders from the owner, construction delays and manufacture delays.
- ∑ The three biggest factors influencing the cost of constructing a facility in general are: square footage, volume, and choice of systems and materials.

- ∑ The cost per square foot ranges greatly and does not appear to be correlated to community wealth or type of facility.
- ∑ No detailed data is available regarding total cost of school construction in Georgia. Some data is collected on schools constructed with state capital outlay funds.
- ∑ No data regarding change orders, evaluations of projects and contractor performance are collected by a centralized information system.

D. Construction Materials

- ∑ No state guidelines exist that help or encourage the choice of materials based on initial versus long term cost, maintenance, or durability.
- ∑ The state funding policy places natural constraints on the types of materials many school systems can use in construction.
- ∑ Many stakeholders are risk adverse and reluctant to experiment with new materials and methods.
- ∑ Materials used are similar across the nation because of building and life-safety codes or the item is time tested and has proven durability and low maintenance cost.
- ∑ Some states, as part of their design standards, have an approved list of materials that are proven and appropriate for school construction.

V. ALTERNATIVES

In Georgia, school construction has long been a local activity, with minimal input from the state. However, the state is responsible for a certain percentage of funding for new school construction so the state does have a vested interest. For each of the alternatives listed, various levels of state input exist. Future state policy and procedure will be determined by when and how state leadership decides to guide school construction decisions. At one extreme the state could manage all aspects of school construction. The other side is to continue the status quo with minimal state input and oversight. Other options for input include having the state act as an agent for those schools who desire more input. Another option is for schools in a specific region to pool their expertise and resources related to construction. In any case, the state needs to determine if policies will be recommended or required of the local school system.

The alternatives are organized by four over arching themes. These themes are data collection, best practices, technical assistance and guidance, and required state activities.

A. Construction Management and Delivery

For most of these alternatives, the state could require or recommend the action depending on the level of input the state desires. The state could:

1. Compile data to understand the current practices.

2. Document best practices

   Develop policies and procedures to monitor design and construction professional's performance and compliance with standards. Report the data to DOE.

3. Provide technical and expert assistance and guidelines.

   A. State or third-party to provide assistance to local school systems in the construction process from start of planning process, during construction phase, and to project closeout.

   B. Develop and provide checklist or outline to assist local school systems in the construction process from start of planning process, during construction phase to project closeout.

   C. Develop a curriculum and certificate program for education leaders in schools systems with no in-house program management staff. This curriculum would help local education leaders understand how to obtain the required services for construction from other parties.

   D. Have a state pre-qualified list of consultants from which school systems could select a consultant to serve in either a short-term advisory role or in a management of construction role throughout the project.

   E. Pilot test alternative delivery and procurement methods and share findings with Georgia school systems.

4. Set requirements for managing construction.

   A. Require (and fund) local systems to provide a project manager, which includes resident engineers on-site. The project manager could alternatively be assigned to supervise construction within a certain geographical region.

   B. Provide a project manager for each region to assist the local systems on their construction projects.

   C. Require (and fund) A/E firms to employ a qualified construction administrator or a resident engineer as part of their service to local systems.

B. Contractual Issues

The state could:

1. Compile data to understand current practices.

   Survey local school systems for best samples of current construction contracts in use.

2. Document best practices.

   A. Privatize the creation of standard design and construction contracts for local systems' use with input from the state and local school systems.

   B. Require alternatives to litigation for dispute resolution.

   C. Use risk-sharing contract language.

3. Provide technical and expert assistance and guidelines.

   A. Test and possibly implement contracting clauses such as pay for performance, in which a payment schedule is dependent upon meeting performance requirements.

   B. Develop state guidelines for construction contracts.

4. Set requirements for contracts.

   A. Require inclusion and enforcement of state mandated contract language (clauses) as a condition for eligibility to receive state money.

   B. Adopt an existing AIA or AGC model "Owner / Architect" and "Owner / Contractor" agreement for local school system use.

   C. Develop a new model "Owner / Architect" and "Owner / Contractor" agreements for local school system use.

   D. Modify an existing AIA or AGC model "Owner / Architect" and "Owner / Contractor" agreement for local school system use.

C. Cost of Construction

1. Compile data to understand current practices.

   A. Compile, document, and review cost data to understand the range of practices and experience in the state. This data is would feed into an information system on school construction.

   B. Require an accurate reporting to DOE of all change orders.

   C. Develop a database to track true cost of construction. Develop a policy that gives DOE access to all construction documents and cost data. This would help DOE collect the data on construction cost.

2. Document best practices.

   A. Conduct a benchmark study to identify cost drivers and best cost management practices that could be used in Georgia (see School Design paper).

   B. Implement constructability review to minimize change orders during construction.

3. Provide technical and expert assistance and guidelines.

   A. Consider programmatic or culture changes as alternatives to new construction.

4. State requirements for controlling costs.

   A. Require a post-construction performance and quality evaluation of all contractors, the design, and the process.

D. Construction materials

1. Compile data to understand the current practices.

   A. Compile, document and review data on construction materials. Use the data to understand the range of practices, use and, maintenance records of materials used for school construction in the state. This also includes tracking and compiling data on new materials that are being tested for future use.

2. Document best practices.

   A. Document best practices in the state and southeast region related to construction materials for school construction. Identify what new materials and current materials should be recommended.

3. Provide technical and expert assistance and guidelines.

   A. Establish a technical assistance/technology transfer program to introduce project stakeholders to new materials and techniques, as well as assist with project management issues such as waste management, construction safety, and environmental compliance.

4. State requirements for managing construction materials.

   A. Develop a list of materials that can be used for school construction. This list is adjusted based on continual analysis of best practices. Exceptions or new materials to be piloted are approved by the state on a case-by-case basis and closely monitored.

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